

## CLAIMS

What is claimed is:

1 ~~X~~ An apparatus for audio compression comprising:  
2 a searching unit having an input to receive a source vector and an output to  
3 provide a reduced version of a non-structured codebook; and  
4 a first quantizer having a first input coupled to receive said source vector and  
5 coupled to said output of said searching unit.

1 2. The apparatus of claim 1 wherein said searching unit comprises:  
2 said non-structured codebook with codewords broken into a plurality of  
3 overlapping sets, each of said sets being mapped to a representative  
4 codeword, said representative codewords forming a first codebook;  
5 a second quantizer coupled to said first codebook, said second quantizer having  
6 an input to receive said source vector and having an output to provide a  
7 list identifying a subset of said representative codewords; and  
8 a codebook constructor unit coupled to said non-structured codebook and said  
9 first quantizer to form said reduced version of said non-structured  
10 codebook.

1 ~~3~~ An apparatus for audio compression comprising:  
2 a first quantizing unit having an input to receive a source vector and having an  
3 output to identify different ones of a plurality of representative codewords  
4 based on said source vector;  
5 a storage unit having stored therein a non-structured codebook whose codewords  
6 are broken into sets, each set being mapped to a different one of said  
7 representative codewords;

8           a codebook constructor coupled to said first quantizing unit and said storage unit  
9           and having an output to provide a reduced version of said non-structured  
10          codebook; and  
11          a second quantizing unit coupled to said codebook constructor and having an  
12          input to receive said source vector.

1    4.    The apparatus of claim 3, wherein  
2        said codebook constructor generates said reduced version of said non-structured  
3        codebook from the union of the sets corresponding to the currently  
4        identified representative codewords.

1    5.    The apparatus of claim 3 wherein said sets overlap.  
1  
1    6.    The apparatus of claim 3, wherein said first stage quantizing unit provides at said  
2        output a list of indices for the ones of said plurality of representative codewords closest to  
3        said source vector.

1    7.    An apparatus for audio compression comprising:  
2        a storage unit having stored therein a set of candidates including  
3           a set of standard codewords, and  
4           a set of predicted codewords;  
5        a first stage quantizer coupled to said storage unit and having an input to receive a  
6        source vector and a new predicted codeword, said first stage quantizer  
7        having an output to generate a list of error vectors based on said  
8        candidates and said source vector and generate a list of indices of said  
9        candidates corresponding to said error vectors;

10 a logic unit coupled to said first stage quantizer and having an output to transmit a  
11 first subset of error vectors including each error vector from said list of  
12 error vectors with an index from said list of indices corresponding to one  
13 of said predicted codewords, and a second subset of error vectors  
14 including each error vector from said list of error vectors with an index  
15 from said list of indices corresponding to one of said standard codewords;  
16 a first splitting unit coupled to said logic unit and having an output to generate a  
17 plurality of subvectors from said first subset of error vectors;  
18 a second splitting unit coupled to said logic unit and having an output to generate  
19 a plurality of subvectors from said second subset of error vectors;  
20 a plurality of multistage vector list quantizers (MSLQ), certain of said plurality of  
21 MSLQ coupled to said first splitting unit and certain of said plurality of  
22 MSLQ coupled to said second splitting unit, said plurality of MSLQ  
23 having output to generate a plurality of quantized subvectors; and  
24 a quantizer coupled to said plurality of MSLQ and having an input to receive said  
25 source vector and having an output to generate an index from said list of  
26 indices of a best candidate and to generate a list of indices for said  
27 plurality of quantized subvectors from said plurality of MSLQ.

1 A method of audio compression comprising:  
2 selecting from a non-structured codebook a subset of codewords to form a  
3 reduced complexity codebook based on said source vector; and  
4 quantizing said source vector with said reduced complexity codebook.

1 9. The method of claim 8, wherein said selecting includes quantizing said source  
2 vector with a first-stage codebook, said first stage codebook having codewords based on  
3 said non-structured codebook.

1 10. The method of claim 8, wherein said selecting comprises:  
2       searching a first stage non-structured codebook for a list of codewords closest to a  
3       source vector; and  
4       constructing the reduced complexity non-structured codebook based on said list of  
5       codewords.

1 11. The method of claim 10, wherein said constructing comprises:  
2       selecting a different set of codewords from a main non-structured codebook for  
3       each codeword identified by said list.

4 ~~12.~~ A method of audio compression comprising:  
5       searching a first stage non-structured codebook for a predetermined number of  
6       codewords;  
7       looking up a plurality of sets of codewords in a table based on the codewords  
8       selected as the predetermined number, each set of codewords from said  
9       plurality corresponding to a different codeword in said first stage non-  
10       structured codebook;  
11       constructing a non-structured codebook from a union of said plurality of sets of  
12       codewords; and  
13       quantizing a source vector with said non-structured codebook.

1 13. The method of claim 12 wherein said searching includes selecting as the  
2 predetermined number the codewords of said first-stage non-structured codebook that are  
3 closest to said source vector.

1 14. The method of claim 12 wherein said plurality of sets of codewords overlap.

1 15. The method of claim 12, wherein said quantizing includes selecting the one of  
2 said codewords in said non-structured codebook closest to said source vector.

1 ~~16.~~ A method of audio compression comprising:  
2 selecting from a first stage codebook a list of codewords closest to a source  
3 vector, wherein a main non-structured codebook was used to create the  
4 non-structured first stage codebook, wherein the first stage codebook has  
5 fewer codewords than the main non-structured codebook;  
6 using said list of codewords to select a plurality of sets of codewords from the  
7 main codebook;  
8 creating a reduced codebook from the union of said plurality of sets of  
9 codewords; and  
10 selecting from said reduced codebook a codeword closest to said source vector.

1 17. The method of claim 16 wherein each of said sets of codewords from the main  
2 codebook correspond to a different codeword from said first stage codebook.

1 18. The method of claim 16 wherein said plurality of sets of codewords overlap.

2 ~~19.~~ A method of audio compression comprising:  
3 quantizing a source vector with a codebook comprising a set of standard  
4 codewords and a set of predicted codewords;  
5 selecting a list of smallest error vectors based on said quantizing and a list of  
6 indices for codewords corresponding to the error vectors on said list;  
7 splitting an error vector from said list of smallest error vectors into multiple  
8 subvectors with a first splitting unit if said error vector's index from said  
9 list of indices corresponds to one of said set of predicted codewords;

10 splitting an error vector from said list of smallest error vectors into multiple  
11 subvectors with a second splitting unit if said error vector's index from  
12 said list of indices corresponds to one of said set of standard codewords;  
13 quantizing said multiple subvectors with multiple multistage vector list quantizers  
14 into multiple quantized subvectors;  
15 selecting a best candidate based on said multiple quantized subvectors and said  
16 source vector; and  
17 transmitting an index for said best candidate and indices for said multiple  
18 quantized subvectors.

20. The method of claim 19 wherein each of said multiple multistage vector list  
2 quantizers utilizes a different codebook.